

REMARKS

The Examiner's action dated October 3, 2007, has been received, and its contents carefully noted.

In response to the formal rejection of claim 13, that claim has been amended to define the air in the grooves as "compressed"; support for this term will be found throughout the specification, for example at page 6, line 2. It is submitted that this term should properly be considered definite since those skilled in the art are readily aware that "compressed air" is air that is at a pressure higher than atmospheric.

In order to further advance matters, claim 1 has been amended to now include the subject matter of previous claims 2 and 3, which have themselves been cancelled, and to contain minor improvements in form. Since claims 2 and 3 previously depended from claim 1, these amendments to claim 1 DO NOT RAISE ANY NEW ISSUES.

The remaining claims have been amended, where necessary, to provide proper dependency and new claims 14-17 have been added for the Examiner's consideration. Support for the recitations in claims 14, 15 and 17 will be found in the specification, for example at page 9, lines 19-24 and page 11,

lines 2-6. New claim 16 combines the subject matter of the present version of claim 1 with the subject matter of present claims 4, 5 and 13.

In view of the amendments to claim 1 and the content of new independent claim 16, and particularly the fact that each of those claims includes the subject matter of original claim 3, is believed that all of the prior art rejections have been rendered moot, with the exception of the rejection presented in Section 8 of the action and that rejection is respectfully traversed.

It will be recalled that a personal interview was held with Examiners Lewis and Tsang-Foster on June 19, 2007, and an Amendment was filed on July 6, 2007. During the personal interview, significant patentable differences between the invention, as then claimed, and the prior art were pointed out and these points were amplified in the Amendment filed on July 6, 2007.

However, the present office Action does not contain any acknowledgement of the substantive arguments presented during that interview, or of the expanded arguments presented in the previous Amendment and does not contain any response to those arguments. Indeed, the present action does not even acknowledge that the personal interview took place. It is

believed that when an applicant traverses any rejection, the Examiner should, if the rejection is repeated, take note of the applicant's argument and answer the substance of it. MPEP 707.07(f). If the present Amendment does not place the application in allowable condition, it is asked that such response be provided. Accordingly, the statement of the substance of the interview and the essential arguments made in the previous Amendment are reproduced below.

STATEMENT OF SUBSTANCE OF INTERVIEW

During the interview held on June 19, 2007, the references of record were discussed and undersigned counsel explained how the present claims overcome the rejections of record.

In particular, three basic points were made:

1- The present application and the primary reference (Kenyon) are directed to passive airbreathing fuel cells, whereas the other applied references disclose active fuel cells. The considerations underlying the construction of fuel cells of one type are different in significant respects from those underlying the construction of fuel cells of the other type. Basically, those skilled in the art do not consider it to be

"obvious" to modify a fuel cell of one type to include a feature of fuels cells of the other type.

2- The present invention distinguishes over the prior art by the provision of grooves in the porous oxygen passage plate, at the side the faces away from the oxygen electrode, whereas the primary reference does not disclose any grooves and the components that are provided with grooves in the secondary references are not porous oxygen passage plates and have grooves at the side facing the associated oxygen electrode.

3- A particular object of the present invention is to provide compressed, or high density, air in the grooves, which is not disclosed in any of the applied references.

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In order to advance prosecution, claim 1 was previously amended only in a minor respect, *i.e.* to provide proper antecedent basis for the reference to the "porous" oxygen passage plate, and dependent claims 12 and 13 were added to more clearly define two particular features of the invention, which is that the porous oxygen passage plate is made of carbon and that the fuel cell comprises means for forcibly feeding air into the grooves in order to provide air

having a high density in the grooves. Support for the recitations appearing in the added dependent claims will be found in the specification at page 9, line 4 and page 5, line 25-page 6, line 10, respectively.

The rejection claims 1, 2 and 5 as unpatentable over Kenyon in view of Lee was traversed for the reason that neither of these references discloses a fuel cell having a porous oxygen passage plate provided with a plurality of opened grooves on a surface thereof opposed to the oxygen electrode, the grooves being opened to an outer periphery of a porous oxygen passage plate and not extending to, and therefore being closed to, the central bore.

In the office action of March 7, 2007, the examiner asserted that the primary reference, Kenyon, discloses a passive airbreathing fuel cell having a plurality of fuel cell units, each unit including a porous oxygen passage plate. However, the explanation of the rejection included an acknowledgement that this reference does not disclose an oxygen passage plate having a plurality of **grooves**.

The purpose of the provision of a plurality of grooves in the oxygen passage plate according to the present invention is to enable an increased flow of oxygen into the fuel cell so that there is an ample supply of oxygen across

the entire surface of the oxygen passage plate, and thus an increased flow of oxygen to the entire area of the polymer electrolyte membrane.

Because this essential feature of the present invention is lacking from the Kenyon disclosure, reliance has been placed on a secondary reference, Lee, which discloses only active fuel cells. The explanation of this rejection points out that Lee discloses a cooling system in which non-porous electrically conductive plates may contain an array of grooves in the faces that define a reactant flow field for distributing the fuel cell's gaseous reactants.

According to the disclosure provided in the Lee reference, each membrane electrode assembly 4, 6 is sandwiched between two porous gas permeable sheets, such as the sheets 34 and 36 sandwiching membrane electrode assembly 4. Reactant flow fields composed of a plurality of flow channels are provided in plate assemblies 8, 14 and 16. Lee explicitly discloses that each of these plate assemblies is **non-porous**. In fact, in view of the locations of those plates, it would make no sense to make them porous.

Thus, it is clear that Lee does not disclose the provision of a plurality of grooves in a porous oxygen passage plate, on a surface of that plate that is opposed to the

oxygen electrode, and thus does not supply the disclosure that is lacking from Kenyon.

It follows that no reasonable combination of the teachings of these applied references would result in the fuel cell defined in even the previous version of application claim 1.

Moreover, those skilled in the art would have no logical reason to modify the passive fuel cell of Kenyon according to the teachings of Lee because these references disclose two fundamentally different types of fuel cells.

Active type fuel cells, such as that disclosed by Lee, are of the type normally used in motor vehicles or for home use, in which hydrogen and air are continuously and forcibly fed into the fuel cell from external sources. A portion of this hydrogen and oxygen react together and contribute to the generation of electric power, while the portions that are not reacted are discharged out of the fuel cell, the discharged hydrogen being fed back to the fuel cell by a circulating pump.

In contrast, passive fuel cells, such as that disclosed by Kenyon, receive hydrogen from a gas cylinder under pressure, while air is allowed to flow into the fuel

cell under atmospheric pressure. During operation of such a fuel cell, there is no continuous withdrawal of unused reactants.

Thus, one distinguishing characteristic of active fuel cells is that they require auxiliary equipment for positively feeding both hydrogen and air and for withdrawing unused reactants. The electric power required for operating this equipment must be generated by the fuel cell, reducing the power available for other uses.

For the above reasons, those skilled in the art would understand that features of active type fuel cells cannot necessarily be incorporated into passive type fuel cells.

Furthermore, the present invention differs from any device that could be obtained by combining the teachings of the applied references by the fact that the open grooves are on a surface of the porous oxygen passage plate that is opposed to the oxygen electrode. When, as in the case of the present invention, the grooves for supplying oxygen are provided on the side of the oxygen passage plate that faces away from the oxygen electrode, and the oxygen passage plate is clamped against the oxygen electrode by end plates, such as plate 24 shown in Figure 9 of the present application, the

contact pressure between the oxygen passage plate and the oxygen electrode is more uniform than would be the case if the grooves were provided in a metal clamping plate adjacent to the oxygen passage plate, with the grooves and their associated lands being directed toward the oxygen passage plate, as disclosed by Lee (and Reiser).

Thus, claim 1, as previously presented, distinguished over any reasonable combination of the teachings of the applied references by its recitation of a porous oxygen passage plate provided adjacent and toward the oxygen electrode and comprising a plurality of opened grooves on a surface thereof opposed to the oxygen electrode, the grooves being closed to the central bore.

In connection with the above-cited claim recitations, it should also be noted that Kenyon does not disclose any grooves at all and the secondary reference does not disclose a porous plate or grooves on the side of the plate opposed to the oxygen electrode and that are closed to a central bore.

Even though, for reasons set forth above, the previous version of claim 1 clearly distinguished patentably over the prior art, claim 1 has now been amended to include

the further significant features previously defined in pending claims 2 and 3.

In view of the amendments now made to claim 1 (to include all of the subject matter of claims 2 and 3), and the fact that the Lee reference was not relied upon to support the rejection of claim 3, the Lee reference will not be discussed further.

Claim 1 now further recites blowers for blasting air into the grooves. This feature, which is recognized to not be disclosed by Kenyon, would certainly be contrary to the Kenyon disclosure, which relate only to passive fuel cells, one characteristic of passive fuel cells being that they do not provide any forced air flow.

Claim 1 also further distinguishes over any reasonable combination of the teachings of the applied references by its recitation that the blowers are arranged in opposition to both opened ends of the grooves. Of course, the result of this arrangement is to force air into the grooves from both ends thereof, thereby necessarily creating compressed air in the grooves.

As already noted above, it would be contrary to the teachings of Kenyon to add any air blowers to the passive air cells disclosed therein.

The secondary reference relied upon to support this rejection, Reiser, discloses an active fuel cell. Therefore, all of the arguments presented above regarding the absence of any motivation for those skilled in the art to combine teachings relating to, respectively, a passive fuel cell and an active fuel cell are equally applicable to the previous rejection of presently amended claim 1 (which incorporates previous claim 3).

Moreover, Reiser fails to supply the feature, missing from Kenyon, relating to the provision of a porous oxygen passage plate provided adjacent the oxygen electrode and provided with a plurality of opened grooves on a surface thereof opposed to the oxygen electrode.

Reiser does not, in fact, appear to disclose a porous oxygen passage plate. In the fuel cell disclosed in this reference, for example as illustrated in Figure 3D thereof, grooves 28 are formed in the side of a plate 40 that faces toward cathode 22. Plate 40 is **not** an oxygen passage plate, but is only disclosed as being provided to allow water removal. Reference is made to the explanation provided

earlier herein regarding the benefit of providing grooves at the side of the oxygen passage plate that is opposed to the oxygen electrode.

It is therefore clear that one skilled in the art could not derive from the Reiser patent any suggestion for providing a porous oxygen passage plate with grooves at the side of that plate that faces away from the oxygen electrode.

Moreover, it appears that Reiser does not even disclose a component that can be equated to the oxygen passage plate defined in application claim 1 because there is no disclosure in this reference that oxygen passes through any of the plates provided with grooves.

Furthermore, the addition of blowers to the passive fuel cell of Kenyon would be clearly contrary to the disclosure of that reference, which relates to a passive fuel cell.

Wholly aside from the facts set forth above, it would certainly be contrary to the teachings of Reiser to arrange blowers in opposition to both opened ends of the grooves. Reiser clearly discloses an arrangement in which air is caused to flow across the fuel cell, being introduced at one side thereof and being withdrawn through an outlet

manifold 14B at the other side thereof. The entire purpose of the arrangement disclosed by Reiser is to produce a continuous flow of air through the fuel cell. This is directly contrary to an arrangement of the type now defined in claim 1, in which air is blown in at both ends of the grooves, creating compressed air within the grooves and essentially allowing air to exit only through the porous oxygen passage plate.

With regard to the entirety of the explanation of this rejection, as presented on page 9 of the Action, it can only be reiterated that to arrange blowers in the manner now defined in claim 1 of the present application would be directly contrary to the teachings of Reiser and would provide an effect, that is compressed air, that is directly contrary to the effect intended by Reiser, which is a continuous flow of air across the fuel cell.

Moreover, the arrangement of grooves disclosed by Reiser **cannot be employed in a fuel cell** having the form disclosed by Kenyon, which includes a central core that is separated from the region containing oxygen and that constitutes a source of fuel.

The reasoning presented in support of the previous rejection of application claim 3 seems to be contrary to the basic principles underlying determinations of patentability.

This reasoning appears to be that a feature that is not disclosed or suggested anywhere in the prior art (providing blowers at both ends of grooves in order to create compressed air within the grooves), and which is, in fact, contrary to the teachings of the applied references, is nevertheless "obvious" because it "would increase the performance of the fuel cell". Quite to the contrary, it is the understanding of undersigned counsel that if a novel feature that is not known in or suggested by the prior art produces an improvement, this is clear evidence of unobviousness, and hence patentability.

The rejection is unjustified because the fact that the novel arrangement of blowers according to the present invention would increase the performance of the fuel cell is something that was not known in the art. The only evidence that the invention produces an increase in performance is found in the present specification itself. A finding of obviousness is simply unjustified when there is no evidence of prior art knowledge that the novel feature of the invention would produce an improvement.

Moreover, there is no known principle that would lead one skilled in the art to believe that supplying oxygen from compressed air in a fuel cell would lead to any operating improvement. Knowledge of this can only be found in the

specification of the present application, and nowhere in the prior art.

The simple fact is this: disclosures in the specification of an application under examination cannot be relied upon to support an obviousness rejection. If the only disclosure that a modification of the prior art produces an improvement is found in the application self, this cannot serve as the basis for a holding of obviousness.

The present invention not only produces an improvement, but actually produces a surprisingly substantial improvement. Figures 7 and 8 of the present application present documentary evidence that **both** the provision of grooves in a porous oxygen passage plate **and** the blowing in of air from both ends of the grooves produces a substantial increase in the current produced by a particular fuel cell. Taking into account that research into fuel cells has been conducted by many institutions over many years, it must be concluded that the improvements demonstrated in Figures 7 and 8 of the present application are surprising and, in any event, go far beyond any improvement that these features might be expected to produce.

This having been said, it must be reiterated that the prior art does not suggest either of the novel features whose effects are depicted in Figures 7 and 8.

In summary, it is submitted that no one skilled in the art could possibly, even with the Kenyon and Reiser disclosures before them, envision a fuel cell having porous oxygen passage plates provided with grooves as defined in application claim 1, or a fuel cell having blowers that blow air into each of the grooves from both ends thereof. Thus, there is simply no proper evidentiary support for the rejection of previous claim 3, and thus presently amended claim 1.

Claim 5, which depends from amended claim 1, further distinguishes over the applied references by its recitation that the outer peripheral surface of the cell stack is rectangular in shape. This shape is clearly different from the shape disclosed by Kenyon. In connection with this point, it is submitted that the assertion presented in the last two lines on page 5 of the Action is simply incorrect; there is no disclosure in Kenyon that the embodiment shown in Figure 6 thereof has an outer peripheral surface that is rectangular in shape.

Claim 12 further distinguishes over the applied references by specifying that the oxygen passage plate is made of carbon. This is a material that can be provided with grooves more easily than the metal plates disclosed by Reiser.

Claim 13 clearly distinguishes over the applied references by its explicit recitation of a basic novel feature of the invention which, is noted above, represents an effect that is directly contrary to that which occurs in the fuel cell of Reiser.

Added claims 14, 15 and 17 further define the structure of a fuel cell according to the invention according to which the blowers are operative to provide compressed air through the several grooves to the central portion. Support for these claims will be found in the specification at page 10, line 27 to page 11, line 6. It is submitted that the limitations in these claims are not found anywhere in the prior art of record.

Added claim 16 contains the essential subject matter of claims 1, 4, 5 and 13.

Furthermore, it is now requested that the Restriction Requirement be withdrawn in view of the fact that

claims 6-11 do, in fact, define the same apparatus, and in fact the same embodiments, as claims 1-5, 12 and 13.

In view of the foregoing it is requested that the Restriction Requirement be withdrawn, that all claims be examined on the merits, that the prior art rejections be reconsidered and withdrawn, that claims 1-17 be allowed, and that the application be found in allowable condition.

If the above amendment should not now place the application in condition for allowance, the Examiner is invited to call undersigned counsel to resolve any remaining issues.

Respectfully submitted,

BROWDY AND NEIMARK, P.L.L.C.
Attorneys for Applicant

By /jmf/
Jay M. Finkelstein
Registration No. 21,082

JMF:smb
Telephone No.: (202) 628-5197
Facsimile No.: (202) 737-3528
G:\BN\A\ASAM\Takagi11\Pto\2007-12-31 Amendment.doc